REMARKS/ARGUMENTS

Claims 1-47 are pending in the application. Claims 1-27 are rejected. Claims 1 and 21 have been amended. Claims 28-47 have been added. No new matter has been added. In view of the foregoing amendments and the following remarks, Applicants respectfully request allowance of the application.

CLAIM REJECTIONS – 35 USC § 101

Claims 1-14 and 21-26 are rejected under 35 U.S.C. § 101 as not falling within one of the four statutory categories of invention. Applicants have amended claims 1 and 21 to state that the steps of the method are performed "via a video coder." Accordingly, Applicants respectfully request withdrawal of this rejection.

CLAIM REJECTIONS – 35 USC § 103

Claims 1-4 and 13-14 are rejected under 35 U.S.C. § 103(a) as being unpatentable over Tajime, US Pat. No. 6,915,018 in view of Hanamura et al., (hereinafter "Hanamura"), US Pat. No. 6,587,508 and further in view of Ribas-Corbera et al., (hereinafter "Ribas-Corbera"), US Pat. No. 6,111,991. Claim 5 is rejected under 35 U.S.C. § 103(a) as being unpatentable over Tajime in view of Hanamura, in view of Ribas-Corbera and further in view of Nishikawa et al., (hereinafter "Nishikawa"), US Pat. No. 6,222,887. Claim 6 is rejected under 35 U.S.C. § 103(a) as being unpatentable over Tajime in view of Hanamura, in view of Ribas-Corbera, and further in view of Nagumo et al., (hereinafter "Nagumo"), US Pat. No. 7,158,570. Claim 7 is rejected under 35 U.S.C. § 103(a) as being unpatentable over Tajime in view of Hanamura, in view of Ribas-Corbera, in view of Hsia US Pub. No. 2004/0146108 and further in view of Sugiyama, US Pat. No. 6,940,911. Claim 8 is rejected under 35 U.S.C. § 103(a) as being unpatentable over Tajime, in view of Hanamura, in view of Ribas-Corbera further in view of Chiang et al., (hereinafter "Chiang"), US Pat. No. 6,192,081. Claim 9 is rejected under 35 U.S.C. § 103(a) as being unpatentable over Tajime in view of Hanamura, in view of Ribas-Corbera and further in view of Riek et al., (hereinafter "Riek"), US Pat. No. 7,148,908. Claims 10-14 are rejected under 35 U.S.C. § 103(a) as being unpatentable over Tajime in view of Hanamura, in view of

Ribas-Corbera and further in view of Hui, US Pat. No. 6,654,417. Claims 15-16 are rejected under 35 U.S.C. § 103(a) as being unpatentable over Hsia in view of Ribas-Corbera. Claims 17-19 are rejected under 35 U.S.C. § 103(a) as being unpatentable over Hsia in view of Ribas-Corbera and further in view of Tajime. Claim 20 is rejected under 35 U.S.C. § 103(a) as being unpatentable over Hsia in view of Ribas-Corbera and further in view of Mitchell et al., (hereinafter "Mitchell"), US Pat. No. 6,256,422. Claims 21-27 are rejected under 35 U.S.C. § 103(a) as being unpatentable over Pau, US Pat. No. 6,223,193 in view of Hsia.

CLAIMS 1-14 DEFINE OVER THE PRIOR ART

Independent claim 1 recites, in part:

determining a target bitrate for a picture in the sequence based on an estimate of the *picture's complexity*,

generating a first quantizer estimate for the picture *based on a fullness indicator* from a transmit buffer of a video coder,

generating a second quantizer estimate for the picture *based on* **[1]** *a linear regression of quantizer assignments* made to prior pictures of a same type, **[2]** actual coding rates achieved by such quantizer assignments and **[3]** the target bitrate, and

selecting a quantizer *based on a difference between the two quantizer estimates* and based on the estimate of the picture's complexity.

The cited art, even if considered in combination, does not teach or suggest the rate control method recited in claim 1. Claim 1 by its own terms requires generation of two quantizer estimates each based on different sets of data, then selection of a final quantizer based on a comparison of the two estimates. No reference contains any disclosure to select a quantizer based on a comparison of two quantizer estimates as claimed.

The Office asserts that Tajime discloses determining a target bitrate for a picture in the sequence based on an estimate of the picture's complexity. Applicants respectfully disagree. Tajime's "target average bitrate" is "supplied from outside" and there is no teaching or suggestion that it is determined for a particular picture based on an estimate of that picture's complexity. (Tajime, 8:4-5).

Tajime also does not disclose generating a first quantizer estimate for the picture *based on a fullness indicator* from a transmit buffer of a video coder. As teaching this element, the

Office says that in Tajime "the feedback loop from the coder provides the buffer fullness indication," but the Office admits that Tajime "does not explicitly state a buffer full indicator." (Office Action dated April 13, 2009, pg. 4). Applicants agree as there is no mention in Tajime of a "buffer" or a "feedback loop." The Office says that Hanamura "teaches the use of a buffer fullness indicator from a transmit buffer." However, Hanamura's buffer is a *virtual* buffer, not a *transmit* buffer as is claimed, and as is known in the art (and discussed in the specification), virtual and transmit buffers are not the same thing.

The Office asserts also that Tajime discloses the claimed second quantizer estimate at 7:66-8:37, however, Applicants can find no teaching or suggestion that the second quantizer estimate is generated from **[1]** a linear regression of quantizer assignments made to prior pictures of a same type, **[2]** actual coding rates achieved by such quantizer assignments and **[3]** the target bitrate, and the Office has made no attempt to explain such deficiencies. The Office has admitted that Tajime does not disclose linear regression techniques and has referred to Ribas-Corbera for such disclosure (discussed below).

Claim 1 goes further and requires a comparison of the two quantizer estimates – "selecting a quantizer *based on a difference between the two quantizer estimates* and based on the estimate of the picture's complexity." Tajime has no disclosure corresponding to this element, either. While Tajime discloses generating a quantizer value (i.e., "base quantizer step size" computed by complexity measure computing means 101), he fails to disclose generation of a second quantizer estimate; Tajime simply "[adjusts] the base quantizer step size" via quantizer step size adjusting means 103. (Tajime, 8:19-37). The undersigned reviewed the portions cited by the Office Action, 7:66-8:37, 10:23-33 and the figures, but has found nothing to disclose any difference taken between two separate *quantizer estimates*. The cited art simply does not teach or suggest this subject matter.

Ribas-Corbera is cited for disclosure of linear regression in the abstract. Ribas-Corbera has no disclosure of a quantizer estimate that is generated from **[1]** a linear regression of quantizer assignments made to prior pictures of a same type, **[2]** actual coding rates achieved by such quantizer assignments and **[3]** the target bitrate. Moreover, Ribas-Corbera has no disclosure of a difference taken between two quantizers as claimed. Accordingly, this art, even if considered in combination, fails to teach or suggest all elements of claim 1.

Claim 1 is allowable over the cited art. Claims 2-14 depend from independent claim 1 and, therefore, are allowable for at least the reasons applicable to claim 1, even before they are considered on their merits.

CLAIM 4 DEFINES OVER THE PRIOR ART

Claim 4 recites:

> The rate control method of claim 1, wherein the estimate of the picture's complexity is determined by analyzing a number of bits used to represent each pixel in the picture.

The combination of Tajime, Hanamura and Ribas-Corbera does not teach or suggest determining an estimate of picture complexity by analyzing a **number of bits** used to represent each **pixel** in the picture, which estimate is used to influence the selection of a quantizer. Indeed, the cited portion of Tajime does not mention pixels at all.

For at least these reasons, Applicants believe that the rejection of claim 4 should be reconsidered and withdrawn.

CLAIM 6 DEFINES OVER THE PRIOR ART

Dependent claim 6 recites:

> The rate control method of claim 1, further comprising selectively canceling motion vectors of coded blocks in the picture according to a rate control policy selected for the picture.

The combination of Tajime, Hanamura, Nagumo and Ribas-Corbera does not teach or suggest the rate control method recited in claim 6. The cited portions of Nagumo refer to "[generating] the motion vector rededection flag" when "canceling the exclusion of the excluded frame image data by rising the frame rate of the motion picture data...," which is not at all the same thing as **selectively** canceling **motion vectors** of coded blocks in the picture **according to** a **rate control policy** selected for the picture. (Nagumo, 20:21-31).

For at least these reasons, Applicants believe that the rejection of claim 6 should be reconsidered and withdrawn.

CLAIMS 15-20 DEFINE OVER THE PRIOR ART

Independent claim 15 recites:

A rate controller, comprising:

a scene content analyzer having an input for source video data and an output for complexity indicators representing complexity of each picture in the source video data,

a first quantizer estimator having an input for the source video data and complexity indicators, to generate a quantizer estimate of a picture based on a calculation of a target rate for coding the picture,

a second quantizer estimator having an input for the complexity indicators and past values of quantizer selections and coding rates achieved therefrom, the second quantizer estimator to generate a second quantizer estimate for the picture based on a linear regression modeling of the prior quantizer selections and coding rates for like-kind pictures, and

a coding adapter, having inputs for the two quantizer estimates and the complexity indicators to select a quantizer for the picture based on a difference of the two quantizer estimates.

As a threshold matter, Applicants have reviewed the Office's response to Applicants' arguments regarding Hsia (Office Action dated Apr. 13, 2009, pg. 2) and fail to see the relevance of the Office's comments to independent claim 15 (or to independent claims 21 and 27). The Office states in its comments that the "Q_slice disclosed represents the entire frame when the frame is an I-frame thus all slices are equal" and that "complexity is represented when there are a number of slices within the frame that are different." As a preliminary matter, Applicants can find no teaching of either of these statements within Hsia (e.g., Hsia says *nothing* of complexity). Furthermore, by the Office's logic, an I-frame can have no complexity associated with it because all of its slices are equal, which simply is not correct. Finally, claims 15, 21 and 27 say nothing of I-frames. If the Office maintains its rejection based on these portions of Hsia, Applicants respectfully request the Examiner to explain his reasoning in greater detail so Applicants can respond in a meaningful way.

The Office further states in its comments that Hsia teaches "the comparison of the current and previous quantization value." Applicants respectfully disagree. While the Scene Change Detection block of Hsia's Scene Detection Module takes two quantizer values as two of its four inputs, neither of these is either of the quantizer estimates as recited in claim 15 (as detailed below). In any event, the Scene Change Detection block does not select a quantizer

for the picture based on a difference of the two quantizer estimates as is required by claim 15, but rather determines whether there has been a scene change. (Hsia, FIG. 3, para. 45).

In the current Office Action, the Office cites the Scene Detection Module, Quantization Decision Module, and Picture Type Decision Module of FIG. 3 as disclosing the scene content analyzer, however, none of these modules discloses an output for complexity indicators representing complexity of each picture in the source video data. (Hsia, FIG. 3, paras. 44-46). The Picture Type Decision Module outputs the picture type of the current frame (Hsia, FIG. 3, para. 43); the Quantization Decision Module outputs a quantization scale for each slice (Hsia, para. 44); and the Scene Detection Module outputs either a low or high scd signal depending on whether a scene change is detected (Hsia, FIG. 3, paras. 43 and 45).

The Office asserts also that Hsia's Quantization Decision Module discloses both the first and second quantizer estimators of the subject claim. Applicants respectfully disagree. First, the Quantization Decision Module is concerned with quantization scales for *slices of pictures*, and not quantization estimates of *pictures*. Moreover, the Quantization Detection Module outputs only a single quantization scale (i.e., *Q_Slice*) for each slice, not *two*, separately-derived quantization estimates for each picture as is recited in the subject claim. (Hsia, para. 44). Second, the Quantization Decision Module does not have an input for the complexity indicators and past values of quantizer selections and coding rates achieved therefrom.

As with independent claim 1, the Office asserts that the linear regression element is taught or suggested by Ribas-Corbera. For reasons similar to those applicable to claim 1, Applicants respectfully disagree.

Finally, and as discussed above in conjunction with the Office's comments, Hsia does not teach a coding adapter, having inputs for the two quantizer estimates and the complexity indicators to select a quantizer for the picture based on a difference of the two quantizer estimates. While the Scene Change Detection block of the Scene Detection Module takes two quantizer values as two of its four inputs, neither of these is either of the quantizer estimates as claimed, and the Scene Change Detection block does not select a quantizer for the picture based on a difference of the two quantizer estimates, but rather determines whether there has been a scene change. (Hsia, FIG. 3, para. 45).

For at least these reasons, Applicants believe that the rejection of claim 15 should be reconsidered and withdrawn. Claims 16-20 depend from independent claim 15 and are allowable for at least the reasons applicable to claim 15, as well as due to the features recited therein.

CLAIM 17 DEFINES OVER THE PRIOR ART

Dependent claim 17 recites:

The rate controller of claim 15, wherein the coding adapter comprises:
a subtractor having inputs for the two quantizer estimates, and
a clipper coupled to an output of the subtractor.

The combination of Hsia, Tajime and Ribas-Corbera does not teach or suggest the rate controller recited in claim 17. The Office cites the Scene Detection Module in FIG. 3 of Hsia as teaching a subtractor having inputs for two quantizer estimates. For reasons similar to those applicable to the "coding adapter" recited in claim 15, Applicants respectfully disagree.

Also, the Office cites FIG. 1 of Tajime as teaching a clipper coupled to an output of the subtractor, but Applicants can find nothing in the description of FIG. 1 that corresponds to the clipper as claimed.

For at least these reasons, Applicants believe that the rejection of claim 17 should be reconsidered and withdrawn.

CLAIM 18 DEFINES OVER THE PRIOR ART

Dependent claim 18 recites:

The rate controller of claim 17, further comprising a divider coupled to the output of the clipper.

The combination of Hsia, Tajime and Ribas-Corbera does not teach or suggest the rate controller recited in claim 18. The portions of Tajime cited by the Office as teaching the claimed divider are concerned with one of the most well known video coding practices, namely dividing a picture into blocks consisting of groups of pixels. Applicants respectfully submit that the claimed divider has nothing at all to do with the block-generating practice mentioned in

<u>Tajime</u>. Indeed, the entire objective of the coding adapter, of which the clipper is a part, is to generate a quantizer for the ***picture***.

For at least these reasons, Applicants believe that the rejection of claim 17 should be reconsidered and withdrawn.

CLAIM 20 DEFINES OVER THE PRIOR ART

Dependent claim 20 recites:

> The rate controller of claim 15, wherein the coding adapter comprises a lookup table indexed by a complexity indicator representing complexity of the picture and the picture's coding type.

The combination of <u>Hsia</u>, <u>Mitchell</u> and <u>Ribas-Corbera</u> does not teach or suggest the rate controller recited in claim 20. The Office cites the following from <u>Mitchell</u> as teaching a lookup table indexed by a complexity indicator representing complexity of the picture and the picture's coding type:

> The quantization described in the background is the linear quantization used in international image data compression standards such as JPEG and MPEG. There is no requirement that the quantization be linear. Any mapping that reduces the number of transform data levels in a deterministic way can be used with this invention. [...] Actual embodiments may use a lookup table or a sequence of comparisons to achieve similar results.

(<u>Mitchell</u>, Col. 6, lines 26-34). Nowhere in <u>Mitchell</u> is it taught that the lookup table is indexed by a ***complexity indicator representing complexity of the picture and the picture's coding type***.

For at least these reasons, Applicants believe that the rejection of claim 20 should be reconsidered and withdrawn.

CLAIMS 21-26 DEFINE OVER THE PRIOR ART

Independent claim 21 recites:

> A method for identifying a scene change from a sequence of video data, comprising:

> for a plurality of macroblocks of an input picture, computing variances of a plurality of blocks therein,

> **comparing minimum variance values of the plurality of macroblocks to corresponding minimum variance values of macroblocks from a prior picture,**
>
> calculating an activity level of the input picture from the variances,
>
> **comparing the activity level of the input picture to an activity level of the prior picture, and**
>
> **generating a scene change decision from the two comparisons.**

The combination of <u>Pau</u> and <u>Hsia</u> and does not teach or suggest the method for identifying a scene change as recited in claim 21. In particular, the combination of <u>Pau</u> and <u>Hsia</u> does not teach at least comparing minimum variance values of the plurality of macroblocks to corresponding minimum variance values of macroblocks from a prior picture; comparing the activity level of the input picture to an activity level of the prior picture; or, generating a scene change decision from the two comparisons. The Office cites the following as teaching the first two elements highlighted above:

> The accelerator of the invention is a Variance Estimator Engine (VEE), which comprises the functional blocks depicted in FIG. 9. The core of the variance estimator interacts with the external world through a normal Direct Memory Access (DMA) engine for the input of the pixels, and for writing in a memory the results of the processing carried out (the calculated variance values and activity). The DMA reads from the central memory of the encoder system, macroblock by macroblock, a picture and inputs it to the core of the variance estimator, according to an alignment as the one shown in FIG. 7b. Starting from line 1 at the top left corner, all the lines of the macroblock are scanned down to line 32 before restarting again with line 1 of the next macroblock. As far as the architecture of the core is concerned, a first block, squares pipeline, calculates the square of each pixel for use later for the calculation of the variance. This is performed in the block 1 of the diagram of FIG. 8.
>
> [...]
>
> The third block, variance and activity estimator, calculates the square of the value output by the block 4, the algebraic summations, and the final divisions for obtaining the variance values, and the activity from the partial results.

(Pau, 6:43-60 and 7:1-5). Applicants respectfully submit that nothing within these citations or indeed anywhere within <u>Pau</u> teaches 1) comparing minimum variance values of the plurality of macroblocks to corresponding minimum variance values of macroblocks from a prior picture, and 2) comparing the activity level of the input picture to an activity level of the prior picture.

Further, Hsia fails to teach generating a scene change decision from the two comparisons as described in the subject claim. The Office cites the Scene Detection Module in FIG. 3 of Hsia as teaching this element (described in Hsia at para. 45). While the Scene Detection Module detects a scene change, the detection is not at all predicated on two comparisons as claimed, much less two comparisons that are functions of variance values and activity levels, respectively. Indeed, Hsia makes no mention of activity levels or variance values. Therefore, the combination of Pau and Hsia fails to teach or suggest each and every element of claim 21.

For at least these reasons, Applicants believe that the rejection of claim 21 should be reconsidered and withdrawn. Claims 22-26 depend from independent claim 21 and are allowable for at least the reasons applicable to claim 21, as well as due to the features recited therein.

CLAIM 27 DEFINES OVER THE PRIOR ART

Independent claim 27 recites:

A scene change detector, comprising:

a variance calculator to calculate a plurality of variance values for each macroblock in a source image,

a minimum variance selector to select a minimum variance value for each macroblock,

a memory to store minimum variance values of a previously processed image,

a comparator to compare the minimum variance values of the source image to the minimum variance values of the previously processed image,

an averager to calculate an average variance value for each macroblock,

an activity calculator to calculate an activity level of the source image from the average variance values, and

decision logic to signal a scene change based on a comparison of an output from the comparator and the activity level of the source image.

The combination of Pau and Hsia does not teach or suggest the scene change detector as recited in claim 27. Support for nearly all of the rejections made by the Office with respect to

claim 27 is purportedly provided by the same short portions quoted above in conjunction with claim 21, and Applicants kindly direct the Office to those quotes. Applicants respectfully submit that they can find no teaching or suggestion of the above-highlighted elements of claim 27 anywhere in Pau, much less in the portions cited by the Office. Pau is concerned with variances and activity levels, but that is where the similarities to claim 27 end.

Furthermore, Hsia fails to teach decision logic to signal a scene change based on a comparison of an output from the comparator and the activity level of the source image. The Office cites Hsia's Picture Type Decision Module as teaching this element, however Applicants fail to find such a showing. (Hsia, FIG. 3). As described in paragraph 43 of Hsia, the Picture Type Decision Module takes *as an input* a signal from the Scene Detection Module indicating that a scene change has been detected; it does not output such a signal. The Scene Detection Module of Hsia does signal a scene change, however, said signal is not based on a comparison of an output from the comparator and the activity level of the source image, as described in the claim. (Hsia, FIG. 3, para. 45).

For at least these reasons, Applicants believe that the rejection of claim 27 should be reconsidered and withdrawn.

CONCLUSION

In view of the above amendments and arguments, it is believed that the above-identified application is in condition for allowance, and notice to that effect is respectfully requested. Should the Examiner have any questions, the Examiner is encouraged to contact the undersigned at (408) 975-7500.

The Commissioner is authorized to charge any fees or credit any overpayments which may be incurred in connection with this paper under 37 C.F.R. §§ 1.16 or 1.17 to Deposit Account No. **11-0600**.

Respectfully submitted,

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